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U.S. Office for Emergency Management

Materials for defense

Washington, D.C.

[1941]

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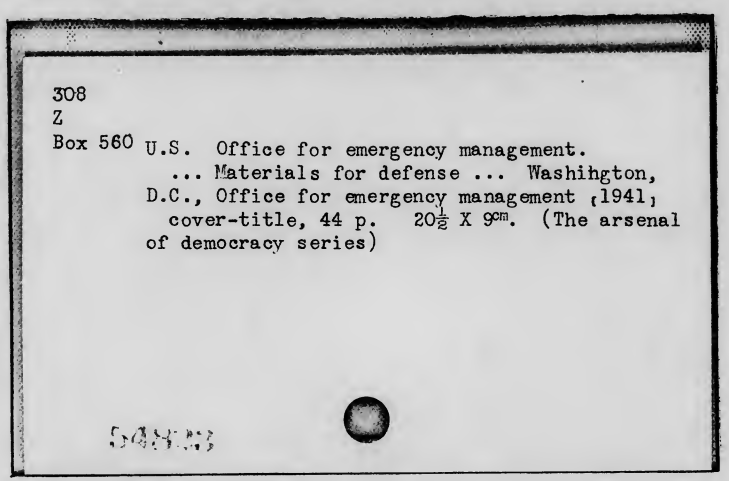

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THE ARSENAL OF DEMOCRACY SERIES

MATERIALS FOR DEFENSE

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OFFICE FOR EMERGENCY MANAGEMENT
WASHINGTON, D. C.

THIS NATION OF FREE MEN is engaged in an all-out effort to defend its freedom.

WHY?

Because our security is threatened from without by guns, tanks, planes, and ships aimed at the heart of democracy.

There are also those who would destroy it from within.

Their scheme is to stimulate doubts deliberately as to the motives of the majority and the majority's democratically elected leaders.

They try deliberately to confuse the public thinking by false statements and insidious suggestion.

They hope to prevent, or at least delay, prompt and decisive action for defense.

They are doing a job for Hitler, who has said:

"Mental confusion, contradiction of feeling, indecisiveness, panic; these are our weapons."

If you have doubts about any phase of defense, ASK FOR FACTS!

DIVISION OF INFORMATION
OFFICE FOR EMERGENCY MANAGEMENT
WASHINGTON, D. C.

MATERIALS FOR DEFENSE

Defense Materials Are Vital

This is a story of shortages—shortages of raw materials, raw materials vitally necessary for the defense of the Nation and its people. To make guns and tanks and planes and ships, to make the United States an actual Arsenal of Democracy for embattled free nations throughout the world, vast quantities of these raw materials are needed.

We are just beginning to realize how big these quantities really are. When this country started its great defense production program, no serious shortages of raw materials existed. Production experts knew that we faced a tremendous problem in stepping up machine-tool output, in retraining personnel and reorganizing factories, but our material supply did not appear too bad. At least, an increase in demand such as has occurred was not expected.

But modern warfare is a war of machines; machines demand metal. Thus even America's vast productive capacity in steel, copper, aluminum, and their alloys has proved insufficient to meet both military and civilian demands.

This problem has been met in the embattled nations by virtually stopping nonessential materials and the civilian population gets along as best it may. England, for instance, now is down to about 400 new civilian automobiles per month. We, too, are going to have to get along without some of the luxuries to

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which we are accustomed if we are going to produce as we need to produce.

Defense materials are sometimes classified in two general categories: "critical" and "strategic."

Critical materials, in the technical sense, are those which are produced in this country and in which supply problems exist. The method to be followed with these is to increase our output, build new factories, open and locate new mines and new sources. At the same time, we must reduce nonessential production using these materials, reduce waste, and conserve articles made with them which can be reclaimed for future use. In this category fall steel, aluminum, magnesium, and certain chemicals.

Strategic materials are those which must be imported, entirely or in part, from other countries and in which serious supply problems exist. Our supplies depend upon shipping facilities and free shipping lanes. The most obvious examples are tin and rubber from China, Malaya, and the Netherlands Indies, but many other vital materials come from the far places of the earth.

Our attack on this problem is twofold: first, to increase domestic production, if that is possible, to its limits, and, second, to build up a reserve supply in the United States sufficient to tide us over any probable stoppage of imports. Here again limitations on civilian consumption are necessary and conservation of reclaimable material important.

The only real limits to the productive capacity of the United States translated into military equipment are limits of materials. We can and we are turning out machine tools; we can and we are training workers in defense skills; we can and we are bringing industry, large and small, into defense production. All of these methods, however, call for vast and increasing quantities of materials.

"All Out" for Production

The Office of Production Management, the Defense Plants Corporation of the RFC, other governmental agencies, and private industry are now engaged in a worldwide program designed to increase the flow of raw materials into American industry.

The one great question confronting the people of the United States today is how rapidly we want to get this job done. If we want to tighten our belts, go "all out" for military production, it is virtually certain we can halt aggression in a comparatively short time. We have productive capacity unmatched in the world. It is up to the American people whether or not we use all of it for defense production. If we do we can return to normal living far sooner than if we demand our customary luxuries.

The following articles tell of our present shortages and what is being done to overcome them, what the public is going to have to do without, and why we *have* to be thrifty with critical materials to keep democracy for the people.

Aluminum and Defense

The United States probably will produce this year twice as much aluminum as the entire world production of 1936—and yet there will not be enough aluminum to go around. This light, strong metal plays a leading role in National Defense production, particularly in airplane construction, and so great is the demand it is impossible to forecast when the supply will catch up.

These figures on primary production alone, excluding secondary production and imports, show the dizzy speed at which America's aluminum output is climbing:

Year	*Production in pounds*
1936	224,000,000
1939	327,000,000
1940	412,000,000
1941 (est.)	600,000,000
1942 (est.)	800,000,000

These figures all go much higher, of course, when secondary production and imports are added in.

Rapidly as aluminum production has increased, demand has kept ahead of it. Consumption in 1940 totaled 592 million pounds and demand in 1941, if civilian uses were not being curtailed, would reach the estimated total of 1,400,000,000 pounds.

It is difficult at present to put aluminum figures down and make them stay there. They're the broken-field runners in the production game. Reasons for this are many and they run about in this order:

1. The raw material from which aluminum is obtained is bauxite. From it alumina is manufactured, and from alumina comes aluminum. It takes about two tons of bauxite to produce one ton of alumina and two tons of alumina to produce one ton of aluminum. Whenever production capacity for aluminum is expanded, corresponding expansions must be made for alumina. Thus, building new aluminum plants is only half the problem.

2. The use of aluminum for military equipment, particularly in aircraft, is all tied up with the production of magnesium. Aluminum-magnesium alloy is a light, tough material that is highly prized by aircraft makers for frames, engines, propellers, wheels, and other parts.

3. Not only is our expanding airplane production calling for greater amounts of aluminum, but the trend to heavier planes calls for more aluminum per plane. A single-seater fighter uses some 5,500 pounds of aluminum alloy, while a heavy bomber takes 20,000 pounds.

4. Vast new plants now are under construction in the United States, others are about to enter construction, and still others are being projected. The dates on which these plants actually will enter into production are, of course, not definite. If no complications ensue—a somewhat rosy viewpoint—the United States next year will have a flow of aluminum never equaled in the history of the world.

More Must Be Produced

Even if aluminum figures are hard to pin down, this much is certain—if the defeat of the Axis is to be insured within a reasonable number of years, larger and larger amounts of aluminum must be produced. No other metal, with the exception of steel, is of greater importance in the making of military equipment.

Besides its use in aircraft, aluminum is an essential component of tanks, armored cars, and Naval vessels. It is used in the manufacture of ammunition, guns, field kitchens, mess kits, and many of the other tools of war where lightness and strength are required. It has important chemical uses, too, and as an abrasive. There just isn't any chance for aluminum to be released for civilian purposes until this emergency is over. There is none for ex-

port, either, except some to Great Britain for airplane construction and a small amount to South America.

Increased production of aluminum calls, of course, for increased production of bauxite, the aluminum ore. We import about 60 percent of our supply from British and Dutch Guiana. The remainder comes from Arkansas. Both our imports and our domestic production have been increased sharply this year.

An unusual preparedness program is taking place in Arkansas, where bauxite lies from 5 to 75 feet below the surface of the ground. The ore always has been "strip" mined; that is, the earth removed above it and the bauxite taken out as needed. Now, however, the earth-removal process is going on full tilt over a great area and the bauxite veins exposed. Thus, as rapidly as it is needed, the ore can be scooped up quickly and started on its way to make airplane engine parts, light and strong, which give American engines greater performance per horsepower than any other.

There is a sound reason for uncovering that bauxite ore. We have enough, it is estimated, to take care of U. S. demands for two or three years. If we found it impossible to get ore from the Guianas for any reason, our aluminum production would not suffer, at least for a time. Aluminum men do not like to contemplate such a contingency, however remote, but they are taking no chances. Defense comes first, these days.

The tremendous military demand (airplane construction alone is taking about 75 percent of our aluminum supply) has, of course, stopped all but essential civilian uses, and the metal was the first on which priority action was taken.

General Preference Order M-1, March 21, 1941, placed all producers, prime and secondary, and all fabricators under a general priorities system. Deliveries can

be made only in accordance with preference ratings issued by the Priorities Division, Office of Production Management, and monthly schedules of deliveries must be submitted to the Division. Other priority orders place aluminum under the most rigid control.

Axis Has All It Needs

While the United States is busy stepping up its aluminum production and seeking new sources of bauxite, the Axis powers face no such problem. France long has been one of the large producers of bauxite, and large deposits also exist in Hungary, Italy, and Yugoslavia. In fact, the Axis probably is better off in the aluminum field than in any other, and there is little doubt that aluminum is being used there to replace the deficiencies in other metals.

Great Britain has stepped up its production of aluminum greatly in the past two years and Canadian capacity has been more than doubled. Although Canadian exports to the United States declined in 1940 and the early part of 1941, due to British demands, this country has purchased a large supply from Canada to be delivered during the emergency years. Canadian exports to the United States were resumed in the fall of 1941.

While aluminum long has been regarded as an essential military material, not even experts in that field forecast any such demand for it as has taken place since National Defense production started. As is the case with most metals, we had more than enough for all civilian demand. Its use in aircraft is a new use, and one that has swept the world in a short time. The demand will continue as long as the defense emergency exists—as long as tyranny and oppression threaten the world and the Arsenal of Democracy pours forth an ever-increasing fleet of planes to fight for freedom throughout the world.

Magnesium and Defense

Think of a metal that comes from salt water; that makes Fourth of July sparklers spark and flashlight powder flash and is today a prized material for airplanes, required in every-growing quantities. That metal is magnesium—and it's scarce.

In 1940, the United States produced 12,500,000 pounds of magnesium, and then the demand really started. This year, it is estimated, our production will top 30,000,000 pounds, which will be some 130,000,000 pounds short of the demand. In 1942, according to present plans, we may turn out in excess of 150,000,000 pounds and still be that much or more short of our requirements.

Our shortage is not caused by any lack of raw material. One source of magnesium is salt water and the only limit to supply is the width of the oceans. It has been estimated that one cubic mile of sea water would provide all the magnesium we need for any purpose. But the process of extraction is intricate and calls for a tremendous amount of machinery and electric power. Increasing our production is a job that cannot be done overnight.

Still, the job is being done as rapidly as is humanly possible. Production capacity has been doubled and redoubled, but so rapidly has the demand grown there still isn't enough magnesium to go around. It's all caused by the fact that magnesium alloyed with aluminum makes the best airplane material yet discovered, light and tough, and that incendiary bullets and incendiary bombs are made from magnesium.

Great Britain, China, Russia, and the armed forces of the United States want multiplied millions of these bullets and bombs, and the skies filled with airplanes with which to deliver them.

There has been, until very recently, only one producer of magnesium in the United States. Acting in conjunction with the British government and the Defense Plant Corporation of the RFC, it is rushing new plants to completion that will double and redouble its capacity. It also has licensed for manufacture and made technical knowledge available to other companies to produce magnesium from various sources.

The present tremendous demand is the result of years of research into the field of magnesium alloys. Alloyed with aluminum, it makes a light, tough metal that the aircraft industry has proclaimed as its own. Magnesium is approximately one-third lighter than aluminum and its use in aircraft results in increased pay loads and improved performance.

Use Just Getting Started

Commercial production of this strange metal actually started in 1918, as an aftermath of World War I. It was developed originally in Germany and prior to 1916 our small demand for it was met by imports. When the war stopped importation, American production was rushed and our war needs met.

Twenty years elapsed before American industry got acquainted with magnesium. Its use was just getting well started—in automobiles, for certain machinery parts, and other civilian uses calling for a light, tough metal—when the defense emergency arose.

Our consumption in 1938 was only 2,719,700 pounds. In 1939, it more than doubled, then increased 73 percent over that peak year in 1940. For this year and next the figures become astronomical. The estimated demand for 1941 is approximately 14 times that of 1940. The 1942 demand has no limit.

Several projects for increasing the production of magnesium are under way, in

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addition to the expansion of present facilities. A number of experiments are going on in a search for simplified methods of extraction, either from brine or from magnesium ores.

So important is magnesium to our aircraft and munitions production that these two uses are expected to consume virtually all the American supply as long as the defense emergency exists.

Aircraft manufacturers took 75 percent of the magnesium-alloy products made in the United States in 1940, a rate that has not declined during the present year. Engine and propeller makers used 64 percent of the industry's total, airplane wheel manufacturers 19 percent, and makers of frames the remainder.

So satisfactory has been the record of magnesium alloys for wheels that 75 percent of the civilian and military planes now being built are so equipped. The low weight of American airplane engines per horsepower also is attributed to the use of this alloy. Other uses are being tested. Not only has the consumption of magnesium been spurred by the great increase in our aircraft production but by the increased use per plane.

Second Priority Metal

Because of that, magnesium was the second metal upon which formal mandatory priorities were invoked. It has long been listed as a critical material by the Army and Navy Munitions Board, chiefly because of its use as an incendiary, for flares, and for other military purposes.

On February 12, 1941, the Priorities Division of the Office of Production Management requested producers to allocate all metal to defense needs. On March 3 it was placed on a mandatory priorities status. Monthly data on needs are gathered by the Division and allocations are made accordingly.

As a part of their long-time plans for world conquest, the Nazis long ago saw to their magnesium production. They produced almost half the world's total in 1940. This is how the world production picture looked at that time:

	Percent
Germany	46. 4
Great Britain	17. 1
United States	13. 9
Japan	9. 8
France	4. 9
U. S. S. R.	3. 7
Italy	2. 5
Switzerland	1. 7

As is the case with many other phases of defense production, the United States is attempting to do in two years what Germany did in seven. When we succeed in stepping up our magnesium production to meet our defense demands it will mean another triumph for American methods and additional ammunition in the Arsenal of Democracy.

Steel and Defense

Steel is armament for America. That is why civilians are faced with a steel shortage. Some estimate that this shortage of steel for nondefense may go over 10,000,000 tons for 1941, and some think the shortage is even greater. Even today it isn't always easy to get steel quickly for civilian purposes, because defense also needs steel—demands it in many times the quantity it needs copper, aluminum, tin, zinc, and brass.

We need steel for tanks and guns and planes, steel for blitz buggies, for 45,000-ton battleships, and for all the machines and arms of modern warfare. If America is to be strong and impregnable against aggression, then steel will make it strong. Steel, in the modern iron age, is the groundwork of defense.

Closely related to armament is a wide range of indirect defense needs. Steel is needed for the hulls of new merchant ships, for new freight cars, for defense housing, for new industrial plants, for electric power plants—all taking millions of tons.

But steel is also raw material for the things consumers buy—automobiles and fly swatters, washing machines and scissors, refrigerators and razor blades, oil burners and tweezers—and that's the rub. One simple example is the refrigerator in your kitchen. There are approximately 140 pounds of steel in that refrigerator. In 1939, we produced 2,000,000 such refrigerators. In them was enough steel to make 20,000 light tanks, or 56,000 37-mm. anti-aircraft guns, or 15,000 4-ton trucks, or the hulls of about 21 heavy cruisers.

That points up the problem: We don't produce enough steel to meet our civilian needs and defense needs too.

During the current year our steel mills will probably turn out over 83,000,000 tons of the metal. A third of that—close to

28,000,000 tons—will go for "direct defense" needs and for exports. Other "indirect defense" needs—things like freight cars, new industrial plants, etc.—may up that demand considerably.

Next year, production may go over 87,000,000 tons. But, as fast as production goes up, defense needs for steel will climb even more rapidly. Just counting direct defense requirements, including aid to foreign countries—and not taking into account the "indirect defense" requirements and the "essential civilian needs"—it is possible that 35,000,000 tons of steel will be lopped off this pile.

The inevitable conclusion is that as severe as the steel shortage for ordinary consumers will be this year, the shortage will be just as bad or even worse in 1942. True, plans are in the making for a boost of 10,000,000 tons in the nation's steel-producing capacity. But that takes time, and even when the increased production is available, defense requirements will be waiting to absorb it.

First Call for Defense

Today, defense gets first call on all the steel made in America. That is as it should be: first things first, until America is powerful enough to stand fast against all threats and dangers. Some of the steel that has been going into automobiles and typewriters and paper clips must now be rerouted, shuttled into the foundries and factories of defense.

Since we can't produce enough steel to meet the needs of civilian production and the needs of defense, we do the next best thing: tag all the steel required for defense, then allot as much as possible to production of essential civilian goods, and assign what is left to those civilian products which we need—but can live without.

The arms program wasn't many months old before steps were taken to assure a sufficient supply of steel for all predictable

defense needs. The picture, as America began to tool up, was that of a nation rich in automobiles, rich in washing machines, rich in refrigerators—rich in all those things that made America the envy of the world. We had these things because the raw materials were available in ample quantities to meet all our needs.

Then, a year ago, defense began to nibble at this wealth. Out of every 100 pounds of steel in 1940, 18 went into cars, trucks, and—something new on the list—mechanized military equipment. Thirteen pounds went for roads, dams, bridges, factories—and army cantonments. Ten pounds were set aside for the railroads. An equal amount went for tin cans, steel drums, and other metal containers. Some of that was for defense.

The 49 pounds that were left were earmarked for industry, for the machinery and tool makers, for ordnance manufacturers and ship builders, and for manufacturers of everything from watches to airplanes.

Steel in Defense

Effecting the turnabout—directing the flow of steel away from peacetime consumption and into the defense factories—has been accomplished in several ways.

In the first place, there is priority control. That means first claim on all steel is given to Army and Navy requirements. Then come other defense needs, such as construction of arms factories. After that, products needed for the general welfare—new hospitals, highways, and the like. And finally come the nonessentials—the things that America is used to but can get along without for the duration.

Secondly, America is cutting down. Already, we have made a frontal attack on one of the biggest peacetime consumers of steel of all; we have decided that while America arms, it must get along with half the automobile production of last year.

On the basis of last year's use of steel in automobiles, that means a saving of 2,747,300 short tons. Other cuts will have to be made—cuts in refrigerators, washing machines, bed springs, and other consumers' durable goods which chew up steel and other critical metals.

Substitutes for Steel

Look at these figures if you want to know why we must cut down: Into a 45,000-ton battleship go 20,000 tons of ordinary steel; into an aircraft carrier, 17,000 tons; into a cruiser, 5,500 tons; into a destroyer, 700 tons. And those figures are exclusive of guns and defensive armor. A medium tank uses 72,000 pounds of steel; a 155-mm. howitzer, 8,960 pounds; a 16-inch Navy shell, 2,000 pounds.

In addition to the belt-tightening necessary, there are other things we can and must do. For one thing, there is substitution: plastics or wood or glass or enamelware where steel was used before. Some companies have already turned to substitutions: wood for steel in croquet-set racks; wood for steel in kitchen utility cabinets; plastics or laminated wood for steel in dinette table tops; asbestos for steel in galvanized steel sheets; porcelain enamel for steel in refrigerator evaporators.

Where it is not possible to substitute, it may be possible to simplify. The steel industry has taken the lead here. Since the start of the defense program, types of steel have been cut down from a thousand to less than a quarter of that number. Bicycle models are being reduced both to stretch supplies and to save on consumption. The same thing is being done with refrigerators, and will be done with other products in the months to come.

Shortages in scrap steel—absolutely essential to production of finished new steel—are being overcome by salvage campaigns. Automobile graveyards are expected to yield upwards of a million tons of scrap.

Abandoned streetcar rails—being salvaged with cooperation of WPA workers—are another source being tapped. Plans are under way for collection of scrap from the nation's farms and back yards.

Axis vs. America

There are bright spots in America's steel picture. Compared with the rest of the world, we turn out close to half of the total steel production. For every 2 tons of steel within Hitler's reach, we have 3. We are currently producing over a third more steel than we did during our peak output during the last war, about a sixth more than we did in the boom days of 1929. Though we need steel for defense, we must sacrifice only a fraction of what we normally use in peacetime. For example, to complete our two-ocean navy will take about 1,200,000 tons of steel; in 1940, the auto industry alone used up 6,900,000 tons of steel.

Our supplies of iron ore, limestone, coal —all ingredients of steel—are within easy reach. But the purifying materials—which give special properties to steel—must come from outside our borders: manganese from Russia, Brazil, Cuba, and Africa; tin from Malaya, the Dutch East Indies, and Bolivia; chromium from Africa, Cuba, and Greece; cobalt from Canada, Africa, and Australia; tungsten from China and Malaya; vanadium from Peru and Rhodesia.

Those materials are being stockpiled, stored against the day when these production sources may be cut off. With that being done, along with curtailment in civilian consumption and the increase in production capacity, America should be able to have enough steel, and be able to deliver it quickly enough, for defense—and this is the important thing, even if it must be achieved by cutting off some of steel's nonessential uses.

Steel will loom large in the Arsenal of Democracy. Steel will be defense against intolerance and aggression. It will be the armament for the protection of American freedom and of those who believe in that freedom. For a year or two America will not have that plenty which has made America rich. There will not be the automobiles and refrigerators and washing machines we have had in the past. But if consumers must go without while America arms, it will be only because America is united in the defense of democracy.

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Chromium and Defense

Chromium lipstick cases and fancy compacts, automobile trim, and stainless steel skillets—these and a lot of other common gadgets that America has become used to in the Luxury Age are going to be much harder to get. The reason is—chromium. We need it for guns and planes and battleships for the Arsenal of Democracy.

At present the United States chromium supply is enough to meet all military and essential civilian demand, but what happens in the future depends on "freedom of the seas," because we get our chromium by way of ships and shipping lanes. The supply-and-demand picture right now goes something like this:

	1940	*1941*
Imports	657, 689	800, 000 (est.)
Domestic production	2, 662	10, 000 (est.)
Total	660, 351	810, 000
Consumption	502, 000	750, 000 (est.)

As the 1942 demand probably will rise 100 to 150 thousand tons over 1941, it is plain that any curtailment of shipping facilities would mean a serious shortage of this important defense material.

Chromium is important for three reasons: It is the principal source of stainless steel and one of the principal alloys that make hard steel for armor plate; it is the most widely used refractory for making linings for steel furnaces; it is an important chemical.

The addition of about 2 percent chromium to steel results in a product of intense hardness and toughness. Its uses are many, the most important from a military standpoint being armor plate. It is also used in the manufacture of axles, springs, parts of gun carriages, automobiles, steel for safes, and armor-piercing projectiles.

When 10 or 15 percent of chromium is added to steel, the result is stainless steel

with which we all have become familiar in the last few years. It is used wherever corrosion must be avoided—in valves, airplane and marine engine parts, and for chemical manufacturing equipment, particularly oil refineries and chemical plants.

In the form of chromite this metal is widely used in the chemical industry. Its pigments of yellow, green, and red are in great demand. It also is used for the tanning of leather and for many other chemical purposes.

The familiar "chrome finish" of recent years, used to decorate automobiles, refrigerators, and many other industrial products, is an electroplated coating applied to any metal, usually steel. It provides a brilliant stainless surface and adheres more closely to the base metal than any other similar finish. This use of chromium is important commercially but uses a negligible amount of the metal.

As a lining for steel furnaces, some substitution for chromium is possible, but most of the possible substitutes are equally important to our defense production, approximately 30 percent of our annual demand being consumed for this purpose. About 50 percent goes into various chromium alloys and the remainder is used by the chemical industries.

Two New Plants Opening

Domestic production of chromium is increasing as a result of defense demands, but it cannot hope on the basis of present known deposits to supply all United States consumption. Deposits are in the Western States and Alaska.

Pressure of defense demands will result in substantial increases in 1942 domestic production, chromium experts estimate, and the United States has built two new plants in Montana which will get into full production around the first of the year. Domestic production may reach 30 percent

of demand by the middle of 1942, which will help, at least, in taking care of essential demands in case foreign supplies are cut off.

This leaves the country largely dependent upon imports, coming principally from Africa. These are the countries from which we imported chromium in 1941:

	Percent
Africa	44
Philippine Islands	27
Turkey	16
Cuba	8
New Caledonia	5

As is the case with a number of other metals and materials used for military production, our dependence upon foreign sources has resulted in the establishment of a reserve supply in the United States. All chromium over essential military and civilian demands is added to the Nation's stockpile for emergency use. The size of the stockpile depends, of course, upon the number of ships available to bring the ore across the oceans.

Because of the necessity to build up our chromium reserves, the metal has been placed under mandatory priority control. A General Preference Order of July 7, and an amendment of August 22, 1941, places restrictions on its use and provides that defense orders must be filled first.

Few Substitutes for Chromium

Unfortunately there are no substitutes for chromium in several of its important uses. Manganese can be substituted in some instances, but as it also is an important metal in steel production little is gained by using it in place of chromium.

There is no lack of chromium ore in the world, South Africa in particular possessing immense reserves. The solution of America's problem all depends upon the ships that sail the seven seas.

The fact of the matter is that chromium and sea lanes and battleships and merchant vessels and civilian gadgets are all mixed up together. We have to conserve chromium for defense, and at the same time, if the sea lanes are not clear for American vessels, we might be in a tough spot even for defense needs.

That is why chromium is getting so much attention now, and why things that happen thousands of miles away in distant lands and distant waters mean so much to every American.

Rubber and Defense

Don't throw away that rubber band. Save it and help solve a big defense problem. For rubber is one of the most far-reaching problems that has popped up since our National Defense effort focused a spotlight on the need for adequate stockpiles of strategic materials.

To an army on wheels, rubber is of paramount importance. And in many of its other uses, such as insulation for electric wiring, rubber is as vital as steel or copper or the other materials of war.

We import all our crude rubber. In the more or less average year of 1940, we imported 818,000 tons and consumed 641,000. We have had for several years a fairly constant demand for around 600,000 tons.

Ninety-eight percent of our crude rubber originates in the Orient. This is where our rubber comes from:

	Percent
British Malay	55
Netherlands Indies	31
Ceylon	7
French Indo-China	4
Other British possessions	1
Africa, South America, etc	2

Despite some shipping difficulties, it seemed no tremendous problem, a year ago, to garner an adequate reserve supply in the United States. Our rate of consumption has been fairly constant during recent years. Thus, rubber men reasoned, all that would be necessary would be to increase our imports this year and the excess could be held back for that very necessary reserve.

Imagine how they felt, then, as they watched consumer demand stretch as fast as, or even faster than they could import rubber!

There were reasons, of course. It was the heavy military demand of our mobile army, plus unprecedented activity in the automobile industry. Regardless of these reasons, however, the stockpile did not grow and it was necessary that steps be taken to make it grow.

One of these steps was a series of priority orders, starting June 20, 1941, limiting the crude-rubber consumption of each processor in the United States. Every effort has been made, in these limitations, to cushion unemployment and to avoid any sudden shutting off of rubber products. The entire plan, as a matter of fact, is to reduce the consumption of rubber to levels not too far from 1940 figures, so that the very necessary reserve supply may be allowed to accumulate.

Consumption Higher Than Ever

Our 1940 imports of 818,000 tons of crude rubber and consumption of 641,000 tons helped the stockpile. Thus, when imports for the first half of 1941 reached almost half a million tons, a comfortable addition to our reserve supply was in prospect. But no such thing happened. Actual consumption for the first half of the year was more than 400,000 tons and requirements for the year are expected to top 750,000 tons.

Next year it will be a different story. The steps already inaugurated should "freeze" consumption at something near the normal level so we can get that reserve.

As is the case with tin and other products of the Orient, rubber supply presents no difficult problem if—but that "if" is a very big one.

If nothing interferes with shipping in the Pacific—if war stays away from the sources of supply—we can continue to get an adequate supply of rubber. War has not stayed away entirely, because occupation of French Indo-China already has cut off our imports from there. The men charged with the responsibility of keeping

us in rubber can only hope the threat to our trade routes goes no further.

That is the reason we must have a large reserve supply of rubber. Nearly 20 percent of our present consumption goes for military and essential civilian use and that 20 percent is vital to our continued defense effort. We must have that rubber and we must be sure of it. The only way to be sure is to have it here in reserve.

With all the many uses there are for rubber—important uses, too—it is surprising to learn that 72 percent of our rubber consumption for the year ended March 31, 1941, went for tires and tire sundries. This is what we did with our rubber last year:

	Percent
Automobile, bus, and truck tires and tire sundries	72
Mechanical goods (hose, belting, and the like)	10
Footwear	6
Wire and cable insulation	4
All other uses	8

If our rubber situation happens to become acute, we have a "first line of defense" in the use of reclaimed rubber. Reclaimed rubber is and has been widely used in this country and now is being used at the rate of approximately 30 percent of crude rubber. It is estimated that this rate of production could be doubled within 12 to 18 months if necessary.

Reclaimed Rubber Important

Reclaimed rubber is superior to crude rubber for certain uses, and a great many rubber products contain a mixture of the two. It is certain that "reclaim" will receive the close attention of the rubber industry and the Federal Government during the period of world emergency.

There is another possible "out" for us in the rubber field in case of dire emergency and that is the production of synthetic rubber. We already are making large

quantities of this product of the chemists' fertile brains, most of it being used for military and defense requirements.

We could, by a heroic effort, build more huge factories for the manufacture of synthetic rubber, but it is doubtful if that could be done rapidly enough to compensate us for the lack of crude rubber in case our supply was suddenly stopped. Rubber men call that a theoretical answer rather than an actual one and point out that synthetic rubber produced in, say, 1944 would be of little use to our defense production effort in 1942.

The only sensible answer, they insist, and their reasoning certainly is logical, is to pile up a reserve supply of rubber in the United States that will last us through any emergency. Then, if we cannot get rubber from the Orient, we will have enough on hand to supply our emergency needs until synthetic rubber production can be stepped up or the situation in the Pacific clarified so shipments can be resumed.

That's why Uncle Sam is asking you to save on rubber. That's why you cannot buy white sidewall tires, and that's why rubber goods may be a trifle scarcer than they have been in the past. The reduced output of automobiles is going to cut the demand for rubber tires to a considerable extent, but rubber will be somewhat scarcer nevertheless.

The way war is conducted nowadays, every bit of material, every scrap, becomes of extreme importance. This war of production, war of materials, and saving of materials is one thing every citizen can do to help his country.

So don't waste rubber. It will help win the war for freedom.

Copper and Defense

A year ago there was plenty of copper. Now we have a shortage. The what-when-where-why of the shortage isn't as sharply outlined as it might be. Statistics are hard to pin down; facts change fast. But these facts are hard and cold and inescapable:

1. Defense needs for copper are big and getting bigger;
2. There isn't enough copper for both civilian use and defense;
3. Civilian uses must be cut.

One reason for the shortage is pretty clear and a good thing for the Nation's safety.

When the Battle for Britain started, all the military experts in the world had figures on how many shells it takes to keep a modern army going in a pitched battle and how many aircraft and anti-aircraft shells it takes to defend the skies. But the figures were low. Slugging it out with the Nazis, on the land and in the air, cost the British hundreds of thousands more shells every day than any paper figures had ever shown. And these shell casings are brass, and brass is 70 percent copper, only 30 percent zinc.

So the brass and copper requirements were shoved up. That meant more red metal for military brass, but it also meant more knowledge of real battle needs and hence more safety.

Now take another look. A few months ago American factories were tooling up. Today production lines are really rolling. A fast-moving line chews up precious metal at a stupendous rate. With airplane production pushing rapidly ahead that means more and more copper.

One type of bomber requires more than 2 miles of copper wire alone to keep it flying. Another needs 500 pounds of copper per ship, which would make thousands of toy electric trains for Christmas. And every time a battleship slides down the ways it means that another 2 million pounds of copper is going to sea.

Battleships versus toy electric trains: essentially that's the choice that we in the Arsenal of Democracy must make. But it isn't only the nonessential uses that must be slashed, for lots of other useful household goods are made of copper, and it's a sure thing that copper is going to be tough to get for such common items as roofing materials, plumbing supplies, lighting fixtures, hardware, and wiring.

Of course nobody arbitarily *wants* to cut down the copper going into the automobiles, the refrigerators, the lighting fixtures, and the vacuum cleaners. But we don't have freedom of choice. The choice has already been made. The battle for democracy overseas means a copper shortage over here.

What Can Be Done

Whenever a shortage comes up, in anything, the question arises: What can you do about it? Well, some things are already being done. Copper supplies are being increased by imports from South America and domestic production is being boosted. Far-seeing manufacturers of civilian goods have already turned successfully to substitutes for copper. That helps.

Elimination of copper from completely nonessential uses—ash trays, for example—is another conservation method, and conservation of industrial scrap, simplification of design, and redesign of items to use less copper are also being invoked.

But despite these opportunities to be thrifty with copper—an opportunity we all must seize—there is no use hiding ostrichlike from the fact that the shortage stares us in the face, and that the copper we do have must be distributed as wisely and as equitably as possible.

How the shortage will actually shape up is a question that has plenty of government statisticians stabbing away at adding machines. And when the adding machines whirred to a stop in mid-autumn, the situation looked something like this:

Supply	*1941 (short tons)*
Domestic production	950, 000
Imports (Latin America)	500, 000
Other imports (Canada, Mexico)	100, 000
Secondary copper	100, 000
Total	1, 650, 000
Demand	
All military (including foreign)	600, 000
Essential civilian	400, 000
Other civilian	880, 000
Total	1, 880, 000
1941 SHORTAGE	230, 000

You can debate these figures. It can be said that the shortage isn't quite as bad as it looks, because inventory buying and hoarding have produced an "artificial demand." On the other hand, it can be pointed out that the Latin-American copper needed this year hasn't all arrived and that shipping difficulties may make the shortage worse.

But the one thing that nobody argues about is the fact that, putting the decimal points aside, America faces a shortage for 1941 *and* 1942. The 1942 estimates (made in September) looked like this:

Supply	*1942 (short tons)*
Domestic production	1, 100, 000
Imports (Latin America)	500, 000
Other imports (Canada, Mexico)	100, 000
Secondary copper	100, 000
Total	1, 800, 000
Demand	
All military (including foreign)	1, 000, 000
Essential civilian	400, 000
Other civilian	1, 170, 000
Total	2, 570, 000
SHORTAGE	770, 000

The figures given for total civilian demand, of course, are based on the theory of unrestricted consumption in accordance with the anticipated rise in national income; that is, the amount of potential buying power created by bigger pay rolls should theoretically increase the demand for copper.

Shortage Is Real

Some of this demand represents relatively nonessential uses—for example, toy trains—but, from any point of view, the shortage is a real one and means that some civilian needs must be lessened so that defense production can be continued at an ever-increasing tempo.

The figures for fall of 1941 show continued high defense requirements; so high, in fact, that the Office of Production Management is making an effort to "squeeze the water" out of any misrepresented defense orders by requiring suppliers to investigate the contracts placed with them.

It is perhaps ironical that copper, like many another critical metal, is so essential for many civilian uses. Wiring, for example, is a big use for copper, and there is no ready substitute save aluminum, which is even scarcer.

But just as copper is needed for civilian purposes it is, for much the same reasons, more essential for military uses. Even with all other production facilities going full tilt, without this red metal used by man since the remotest eras, there could be no naval guns firing their shells over 20-mile trajectories, no rolling tanks.

So it is that defense demands must get first call, even if the resulting shortage for civilian uses causes dislocations. Copper is useful for weatherstripping, for example, but the need for copper weatherstripping now falls into insignificance beside the need for naval and coastal guns, and shells to fire in them, and a sheltering cloud of planes in the skies.

Tin and Defense

The United States consumes more than 100,000 tons of tin a year. Last year we produced domestically 44 tons, mostly from Alaska. That leaves 99,966 tons we must import and that's the reason the hearts of American tin men skip a beat every time war clouds loom up in the Pacific. For trouble in the Pacific, at Singapore or in the Netherlands Indies, might mean drastic curtailment of our tin supply.

Singapore is the heart of the tin world, or the tin heart of the world, whichever you prefer. Of the 124,810 long tons of tin imported into the United States in 1940, 96,454 came from the British Malay States where Singapore is located and 12,101 tons from the nearby Netherlands Indies.

It's a sad fact, but a true one, that the United States just does not and cannot produce any substantial quantities of tin domestically, although this country is the world's largest consumer.

While small amounts of tin are used industrially in the manufacture of bronze and other alloys, and for solder, type metal, and foil, more than half the total annual consumption goes into that standby of American life, the tin can.

Of course the tin can isn't all tin; it is a thin sheet of steel with an even thinner coating of tin, but so important is the "tin" can to our way of living that we regularly use more than half the world's production. The United States produced more than 17 billion tin-coated cans in 1940.

If shipping is interrupted for any reason, that flow of tin will cease. Ancient armies who drove their food supply with them, on the hoof, would not have thought that any cause for alarm, but the modern soldier on the battlefield lives on canned foods. Civilians do too, as a matter of fact, and a curtailment of our tin supply would mean a serious disruption of American life.

The trouble is not that tin is a neglected metal in the United States. We just do not have any ore. A thorough investigation by the United States Bureau of Mines resulted in this report, issued in March 1941:

"These early results tend to strengthen the conviction that no appreciable part of the tin required by American industry can be supplied from known domestic sources, regardless of how great the stringency or how high the price."

And we just must have tin. While its uses are not as varied as are some other metals, it is of vital importance in its various fields. This table shows how our tin is used in an average year:

	Percent
Tin plate	40. 4
Solder	21. 8
Babbitt metal	7. 2
Bronze	6. 8
Collapsible tubes	5. 9
Tinning	3. 1
Type metal	1. 9
All other uses	12. 9

The manufacture of tin cans consumes 90 percent of the tin plate and a large percentage of the solder made with tin.

Faced with the possibility of an interruption of tin supplies from overseas, the Government not long ago decided to do something about it—and did.

The Government Acts

The first step was to begin piling up a reserve stock in this country. At the beginning of 1940, the Procurement Division of the Treasury Department started to acquire a stock pile of tin. So did the Navy. The result is that these and other governmental agencies and private purchasers now have more than a year's

supply of tin on hand in the United States. Of the total, the Government now holds 21,419 long tons of tin in storage which will be held for at least three years after January 1, 1941, as a "crisis" supply.

New Smelter Under Way

A year's supply of tin in storage is a comfortable feeling—but not comfortable enough. It was felt that a surer, safer, steadier source of continuing supply was necessary. The result of that feeling is the new American smelter now under construction at Texas City, Tex., owned by a subsidiary of the Reconstruction Finance Corporation and managed by Dutch East Indies interests. It will have an estimated capacity of 18,000 tons, about 15 percent of the annual national consumption, when it is completed early in 1942.

A second reason, and one of equal importance for the erection of the Texas City smelter, is to provide a market for South American ores, chiefly from Bolivia. With its European markets cut off because of the war, Bolivia faced a domestic crisis until the United States stepped in and contracted for the bulk of its ores. It was practical "Good Neighborliness," for the United States insured a part of its own needs at the same time. The United States has contracted to purchase sufficient ore to provide 18,000 long tons of smelted tin a year from Bolivian producers.

These steps have eased the tin situation in this country to a certain extent, but the men charged with keeping the United States, its soldiers, and its sailors supplied with this vital material still were, and are, looking for corners to cut and new methods of conservation.

Corner on Tin

The method being used at present amounts to a virtual corner on the world's tin supply. Before the outbreak of the war, European smelters refined the bulk of

South American tin. With these closed down, imports into the United States have mounted steadily. This is how the figures on imports appear:

	Tons
1939	70,104
1940	124,810
1941 (est.)	150,000
1942 (est.)	165,000

If the 1941 estimated importation holds true throughout the year, the United States may easily absorb two-thirds of the total world production, estimated at 230,000 tons.

All very well, say the tin men, provided nothing interferes. Of course Great Britain must have guns, they say, and planes and tanks and weapons of all kinds. So must Russia. So must China. But they also must have food, lots of it, particularly England which grows only a small part of the food needed to feed the teeming population of the island.

Food Without Tin Cans?

How would we send food to England without tin cans? How would our ships at sea, so vital to world communications, keep going without canned food?

Faced with these questions, the Conservation Unit of the Office of Production Management moved, in April 1941, to make a further saving in the use of tin. Can-making companies were consulted and an agreement was reached promptly reducing by 10 percent the amount of tin in a can. This can be done in 95 percent of the cans in use without danger of contamination. The amount of tin was not reduced in cans holding certain types of foods. In addition, makers of collapsible tubes were asked to substitute tin-lined tubes for ones of pure tin for shaving soaps.

Further economies in the use of tin are being studied. Electroplated tin plate is a good example, and now is being used quite extensively.

That, in a general sense, is the present

story of tin, one of this Nation's most vital metals. There is nothing wrong with the picture, tin men say, provided:

1. The Pacific "life line" is kept open for a free flow of tin imports.

2. War does not interfere with the production and smelting of tin in Malaya and the Netherlands Indies.

Tungsten and Defense

If importation from China can be continued, there will be no shortage of any consequence in tungsten, a tough, heat-resistant metal that makes high-speed defense production possible. But without Chinese ores, the United States may have to scrape the bottom of the barrel next year to meet requirements. Our supply figures look like this:

	Domestic production (tons)	*Imports*	*Total*
1940	5,120	10,157	15,277
1941 (est.)	6,000	12,000	18,000
1942 (est.)	8,000	4,500	12,500

That 1942 estimate is based upon the assumption that imports from China may be cut off. It is not an unreasonable assumption in view of the generally troubled condition in the Pacific Ocean and the fact that Chinese exports of tungsten concentrates have declined steadily since 1937.

With Chinese exports declining, domestic and South American production has become increasingly important and a constant search is being made for new fields.

Domestic production increased 42 percent in 1940 over 1939 and development work is going on in many new properties in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Washington. California is the largest tungsten producer of the States.

Stimulated by defense demands, tungsten production is expected to rise sharply in 1942, the extent of the rise depending largely on newly discovered deposits now being developed and on the reopening of old mines.

Greatly increased activity in tungsten in South America also has followed the rise in price caused by the war demand. Entries for consumption from Argentina increased

from 76,524 pounds in 1939 to 762,012 in 1940. Bolivia jumped from 96,164 pounds to 1,208,595. Chile exported tungsten to the United States for the first time. Imports from every South American country producing tungsten increased sharply.

It is possible that increased production in this country and receipts from Latin America may take care of our most pressing 1942 requirements. In the meantime, Government agencies are engaged in building a reserve supply in this country as fast as industrial requirements permit.

The estimated 1941 supply—domestic production plus imports—will meet demands for the year on the nose. Requirements are expected to rise at least 2,000 tons in 1942 and an abrupt further increase is far from improbable.

As 92 percent of the tungsten is used in the manufacture of alloy steels and for high-speed cutting tools, its importance in defense cannot be overestimated.

It has the highest melting point of any of the metals and produces a cutting tool that has the sturdiness to stand up under modern production methods.

Tungsten Alloys Vital

Rapid mass production of tanks and airplanes depends upon tools that can take it. Without tungsten-steel alloys, production would be slower and less efficient.

Tungsten alloys are used for railway rails, cold chisels, hack saws, watch springs, valves, armor plate, and in the cores of armor-piercing bullets. Tungsten also is used for the filament of electric light bulbs and radio tubes. While this use is of vital importance, the metal is drawn into a wire so fine that all the bulbs and tubes in the world use only a fraction of the supply.

With a possible tungsten emergency in the offing, measures to conserve it have been taken by the Office of Production Management.

On March 26, 1941, the metal was placed under a general priorities order, requiring that information on stocks, orders, and deliveries be furnished the Priorities Division.

On June 11, further action was taken to conserve tungsten supplies by requiring the use of its first cousin, molybdenum, wherever possible. In many instances it is possible to substitute molybdenum steel for tungsten steel without decreasing efficiency to any appreciable degree.

Tungsten's name implies it is a heavy metal as well as a tough one. It is taken from the Swedish and means (tung) heavy (sten) stone. Some of the valuable properties of this "heavy stone" have not been recognized for very long. Most of its present-day uses are relatively modern.

In 1781, K. W. Scheele learned a great deal about tungsten and its qualities. His name is perpetuated in scheelite, the name of one of the principal mineral sources of tungsten. Wolframite is the other principal ore. The United States produces principally scheelite ore while most of that from other countries is wolframite.

While United States tungsten experts are not exceptionally worried about supplies of the metal, they are disturbed over the possible failure of Chinese shipments.

That's the reason they are limiting its use to essentials, using substitutes wherever possible and encouraging the development of all possible domestic sources.

They hope supplies can continue to come out of China over the Burma Road; they believe larger amounts of ore can be obtained from Latin America; and they can see increased supplies in America.

But tungsten is vital if weapons are to continue to pour forth from the Arsenal of Democracy and defense officials are determined that nothing shall interfere with that flow.

Lead and Defense

History in the Western Hemisphere has always been closely related to the fight for freedom. Lead has played an important role in that fight, and it is an inescapable fact that any real shortage of lead right now would constitute a serious threat to the progress of the defense program.

Lead has always been a useful, if unexciting, metal. The candle mold helped to light a new continent, while from the bullet mold and the powder horn came the ammunition that protected that continent's expanding frontiers, won the War of Independence that established it as a Nation, and decided another war that forever united its States into one great commonwealth.

Then, as now, it was lead that was poured into molds to emerge as a bulwark of democracy.

And then, as now, lead had its uses in the peaceful arts. But when freedom was threatened, as it is again today, there was no question in the minds of America's founders as to where lay the greater usefulness of this essential common metal. It went into the defense of the American way of life.

Lead is one of the cheap metals of commerce, and it is difficult to think in terms of a shortage of so common and little-regarded a product. Yet the picture of the available supply, and the defense and civilian demand for lead in the United States today, is serious enough to call for regulation.

These are the two sides of that picture: The current domestic consumption of lead is at the rate of approximately 960,000 tons a year, although the over-all consumption for the twelve months will probably be not more than 870,000 tons.

At the present time, the estimated supplies are running about as follows:

	Short tons per year
From domestic ores	470, 000
From foreign ores	130, 000
Total	600, 000
Foreign pig lead:	
From Mexico	150, 000
From Canada	96, 000
From Australia	48, 000
From Peru	42, 000
Total	336, 000
Total (foreign and domestic)	936, 000
From scrap	150, 000
Total (foreign, domestic, and scrap)	1, 086, 000

While this shows a small surplus of production and supply over demand, the fact that the imports from Australia and Peru are subject to dislocation by adverse shipping conditions makes for a potentially serious situation. Estimated need in 1942 is for 1,080,000 short tons, and estimated supply from all sources 1,100,000 short tons.

Processing of Lead Expands

In the early months of 1941, the processing of lead expanded rapidly as defense industries began absorbing more and more lead products, and as nondefense industries turned increasingly to lead and lead alloys as substitutes for such critical materials as copper, zinc, and aluminum. To conserve supplies, and to prevent lead from falling into unfriendly hands, the metal was placed under export control on March 24, 1941. Thereafter, all shipments of lead to foreign countries were licensed by the Federal Government.

On May 1, 1941, the Director of Priorities of the Office of Production Management issued General Metals Order No. 1, establishing inventory control over 16 scarce metals and alloys, including lead. On October 4, 1941, lead was placed under full priority control.

Before the impact of the defense pro-

gram, the principal use of lead was for storage batteries, 4,500,000 of which went into the new passenger automobiles put into use in 1940 alone. In the same year, there were on the roads of the United States some 27,500,000 passenger cars, each with its lead storage battery.

More than 220,000 tons of potential armament went into new storage batteries, including those installed in trucks, in 1940. This was approximately 30 percent of all domestic consumption.

Autos or Trucks?

Much of this will be rescued for defense uses by the mandatory curtailments imposed upon automobile manufacturing by the Priorities Division of the Office of Production Management. It is a question of where storage batteries are more urgently needed—in pleasure cars or in Army trucks.

The other fighting equipment of the Navy and Army—trucks, tanks, submarines, and airplanes—all need lead too.

Other uses of lead, also common to defense requirements and civilian needs, are for plumbing and roofing, cable covering, solder, babbitt metal, and in red and white lead.

Strictly military uses, calling for greater and greater quantities of lead are for rifle and machine-gun ammunition, shrapnel and other artillery purposes, for chemical lead, required in the construction of explosive plants, and for tetraethyl lead for the production of high-octane aviation gasoline.

So lead is closely tied in with defense. What happens to lead is part of the story of what happens to the Western Hemisphere.

Zinc and Defense

Battleships, cruisers, and destroyers, as you read these words, patrol the wastes of the Atlantic and the Pacific, defending freedom of the seas. Their propellers are made with zinc. The lining of your ice box, the weatherstripping on your house, and the tops of your kitchen tables—they, too, are made with zinc. In that contrast—defense vs. nondefense—lies the story of another shortage. Approximately, the situation looks something like this:

	1941 (short tons)
Supply	
New domestic production	720, 000
Imports (Latin America)	200, 000
Total	920, 000
Demand	
Defense	340, 000
Indicated unrestricted civilian	890, 000
Total	1, 230, 000
SHORTAGE	310, 000

Since nearly 450,000 tons of concentrates are required for the 200,000 tons of imported zinc to be produced, any further inability to get ships to move the tonnage from South America would seriously reduce the estimated supply.

Estimated requirements for 1942 are for 1,465,000 short tons, and estimated supply 975,000 short tons, representing a possible shortage of nearly 500,000 short tons for that year.

Serious? Very. And here's the explanation:

National Defense put demands on the domestic zinc industry in 1940. By late summer shortages were in sight, and during the last quarter of the year expansion of smelting capacity was being pushed.

By the early part of 1941, producers were prorating supplies to their customers.

On June 11, 1941, zinc was put under mandatory priority control, and this order, which involves the maintenance of a reserve pool of zinc, is still in effect. The pool constitutes a supply from which emergency allocations for defense purposes may be made.

Zinc Die Castings Widely Used

Zinc die castings make possible low-cost production of metal parts in an almost infinite variety. They are widely used in the manufacture of tractors, tanks, and other Army mechanized equipment. Bombers, pursuit ships, and observation planes take on zinc die castings, and, of course, have greater need of them than have manufacturers of passenger automobiles and kitchen equipment.

Look at brass. It is 30 percent zinc, and brass makes shell casings, rifle cartridges, and ammunition clips. Many domestic plumbing accessories, and a great variety of decorative objects—doorknobs, candlesticks, fire irons, ashtrays—also are made of this copper-zinc alloy.

A thin coating of zinc applied to steel protects it from rust. This is the galvanizing process, ordinarily the major use of zinc, and 44 percent of 1939 production was so used. Zinc protects tin roofing, milk cans, wire fencing, wash pails, and other innumerable articles of everyday use in the home and on the farm.

But military and marine demands for zinc constitute a growing proportion of this total. Thirty pounds of zinc goes into each 2½-ton Army truck. Every warship launched by the Navy in its two-ocean program of expansion, every new freighter sent down the ways by the Maritime Commission, needs zinc, and lots of it.

Few Military Substitutes for Zinc

Just as zinc is a rust resistant, so is it a protection against other corrosive elements. It is essential, in heavy plate form, in the insides of the boilers where, from corrosive sea water, is generated the steam that propels both the fighting ships and the cargo vessels they protect.

In the military zone, there are few, if any, substitutes for zinc. The Battle of Britain demonstrated that the number of brass shells needed to wage a modern war at full speed was almost incalculably greater than the world's armament experts had ever estimated. Even in normal times about 28 percent of all zinc produced went into brass. And with the tremendous acceleration in the manufacture of munitions by the United States and the other democracies, a much greater proportion of zinc must be used in brass.

One-third for Hitler

Germany is pretty well fixed for zinc. When the German armies overran Poland, Belgium, France, and Norway, it meant that, with Germany's own production, more than one-third of the world's zinc supply was in Hitler's hands.

These five European countries produced 685,000 short tons of zinc in 1939, a total that was right up to our own figure for that year. Japan was responsible for another estimated 60,000 tons in the same year. These are the latest available figures although production has gone up since.

England used to turn to these countries for zinc, and so, with their normal sources of supply closed to them, the English have had to turn elsewhere for the zinc to fabricate the brass for shells and machine gun ammunition that, in the hands of R. A. F. pilots and antiaircraft gunners, have mocked Hitler's boast of invasion.

Add to this the tremendously increased demand for military brass in the Western Hemisphere, and the impact of the defense program upon civilian uses of this vital metal becomes abundantly clear. Ammunition is more important than brass

plumbing, battleship propellers more useful than zinc-topped tables in the kitchen.

Here, then, is another choice that faces the American people. It is a choice which means inconvenience to the housewife, the farmer, the manufacturer; and, more serious than inconvenience, possible dislocation in certain industries.

It is a choice which will be made willingly if the reason for the necessity is understood.

That reason is, quite simply, National Defense; the necessity, more apparent every day.

U. S. GOVERNMENT PRINTING OFFICE: 1941

Do You Know:

That every ship for our two-ocean Navy has been contracted for, the total cost running to seven and a quarter billion dollars for 2,831 ships of all classes?

That by the end of the year one merchant ship each day will be delivered from American yards to carry goods and munitions to democratic countries throughout the world, and that by the last quarter of 1942 two ships each day will be turned out?

That the United States Army, from a peacetime strength of less than 200,000, is being augmented to a force of 1,750,000 men, with critical equipment for 500,000 more, and that in October of 1941 it had already reached a strength of 1,582,000, an increase of 530.8% since June 1940?

That the goal of the aircraft program is an annual output of 50,000 planes and that manufacturers are already turning out more than 23,000 a year?

That foreign orders placed in the United States from November 1939 to October 1941 totaled $3,674,000,000, of which $2,320,000,000 has been paid?

That the authorized program of National Defense totaled, as of September 30, 1941, $56,792,000,000, allotted as follows:

Army	$24, 607, 000, 000
Navy	16, 978, 000, 000
Lend-lease	7, 000, 000, 000
Other agencies	8, 207, 000, 000

INTENTIONAL SECOND EXPOSURE

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That reason is, quite simply, National Defense; the necessity, more apparent every day.

U. S. GOVERNMENT PRINTING OFFICE: 1941

Do You Know:

That every ship for our two-ocean Navy has been contracted for, the total cost running to seven and a quarter billion dollars for 2,831 ships of all classes?

That by the end of the year one merchant ship each day will be delivered from American yards to carry goods and munitions to democratic countries throughout the world, and that by the last quarter of 1942 two ships each day will be turned out?

That the United States Army, from a peacetime strength of less than 200,000, is being augmented to a force of 1,750,000 men, with critical equipment for 500,000 more, and that in October of 1941 it had already reached a strength of 1,582,000, an increase of 530.8% since June 1940?

That the goal of the aircraft program is an annual output of 50,000 planes and that manufacturers are already turning out more than 23,000 a year?

That foreign orders placed in the United States from November 1939 to October 1941 totaled $3,674,000,000, of which $2,320,000,000 has been paid?

That the authorized program of National Defense totaled, as of September 30, 1941, $56,792,000,000, allotted as follows:

Army	$24, 607, 000, 000
Navy	16, 978, 000, 000
Lend-lease	7, 000, 000, 000
Other agencies	8, 207, 000, 000

Every American has a place in National Defense. It is your right and your duty to know the facts, to know what your Government is doing and how you can help. For further information write:

Division of Information
Office for Emergency Management
Washington, D. C.

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END OF
TITLE